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# Credit Risk Mitigation and SMEs Bank Financing in Basel II: The case of the Loan Guaranteee Associations[*,**]

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**Abstract**

The objective of this paper is to analyse the impact of the techniques foreseen in the Basel Agreement II (BII) for mitigating the risk of default on bank loans to small and medium enterprises (SMEs). In particular, we will conduct an analysis of the effect of the guarantees that the Loan Guarantee Association (LGA) offer to the SMEs on the assignment of capital requirements of the financial entities under BII. At the same time, the study will examine the effect of this guarantee on the credit risk premium that the financial entities should charge their clients, and whether this foreseeable decrease in the interest rates applicable to the SMEs is compensated by the cost of the guarantee.

The results show that, considering that the cost of the LGA guarantee in Spain is around 0.68%, it will be advantageous for an SME with the annual sales of less than or equal to €5 million to request this guarantee whenever the probability of default (PD) of the LGA is <1.1%, if the approach utilised by the financial entity is the Internal Ratings-Based (IRB) and the SME is considered as corporate; however, if the SME is included in a regulatory retail portfolio, then the limit for the PD of the LGA decreases to 0.71%. On the other hand, when the approach utilised is the Standardised one, then will be profitable for an SME treated as retail to request this guarantee whenever the PD of the LGA is <3.35% (3.95% for corporate exposures).

***Keywords:*** Credit risk mitigation - Bank financing of SMEs - Basel II - Loan Guarantee Association.
***JEL Classification:*** G21, G28, G32.

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**CREDIT RISK MITIGATION AND SMEs BANK FINANCING IN BASEL II:**

**The case of the Loan Guarantee Associations**

## 1. Introduction

In June 2004, the Basel Committee on Banking Supervision (BCBS) issued a Revised Framework on International Convergence of Capital Measurement and Capital Standards (hereinafter Basel II or BII). Even today, the new Basel Capital Agreement is increasing the concern felt among small and medium enterprises (SMEs), financial entities, regulators, and national bodies, regarding the effect that the new standard will have on the credit policy[1].

One of the goals of BII is to establish capital requirements that are more sensitive to risk, which could increase the risk premium that the financial entities charge on SMEs. This would increase the rates of interest applied onto their loans, and as a result, would exacerbate their very well-known financing difficulties.

To improve the companies' credit access, firms are obliged to provide guarantees or collateral in most of the cases. To mitigate risk, the new Agreement allows companies to make use of collateral, guarantees and credit derivatives, on-balance sheet netting, mortgages, etc. Thus, it turns out to be interesting to banks to know the impact of such techniques on their capital requirements, since this could mean that some types of credit-risk mitigation techniques are more advisable than others.

There are various studies in the literature analysing the impact of the financing of SMEs on the capital requirements of the financial entities, and its possible effects on bank financing. Altman and Sabato (2005) analysed the effects of BII on the capital requirements of financial entities using data from the USA, Italy, and Australia. They concluded that the banks would have significant

benefits in terms of lower capital requirements, when considering small- and medium-sized firms as retail customers, provided the internal ratings-based (IRB) approach is applied. However, for SMEs treated as corporate, the capital requirements are considered to be slightly greater than under the Basel I Capital Accord. This leads to the assumption, in their opinion, that most financial entities would apply both the systems simultaneously; i.e., they would consider one part of the credits granted to SMEs as corporate and the other part as retail. Through a breakeven analysis, they observed that the banks would be obliged to classify at least 20% of their SME portfolio as retail to maintain the current capital requirement. According to Berger (2006), the adoption of the advanced IRB approach proposed in BII by large credit entities in the USA may not signify a reduction in the interest rates applied to the credits granted to SMEs, but may be enough to produce a substitution effect with respect to other credit entities of smaller size.

Remarkable studies that have considered BII are those by Altman, Bharath, and Saunders (2002); Decamps, Rochet, and Roger (2004); Dietsch and Petey (2004); Kerkhof and Melenberg (2004); Lindquist (2004); Repullo and Suárez (2004), among others.

In Spain, Vargas (2001) studied the techniques for credit risk mitigation presented in the first consultative document of BII, and Saurina and Trucharte (2002, 2004) analysed the consultative documents issued prior to the approval of BII, focusing their analysis on the SMEs and their repercussions on the bank financing of Spanish companies. They observed that the modifications made in 2002, considering part of the financing of SMEs as retail or incorporating an adjustment for size in the curve corresponding to the corporate category, substantially improved the figures of capital requirements demanded, which

were reduced on an average to 6.5% for the IRB approach and 6% for the Standardised approach for those SMEs included in the retail category. The rest of the SMEs included in the corporate category also saw that the capital required reduced to 10.23% and 8% for the IRB and Standardised approaches, respectively. Thus, they concluded that at least at the level of the Spanish credit system as a whole, there were no incentives for a change in the current pattern of bank financing provided to companies, although the final effect will depend again on the percentage of financing provided to SMEs considered as retail. It is worth stressing the point that these results obtained did not take into consideration the latest modifications prior to the definitive approval of the agreement.

As a particular case, we will emphasise the guarantee presented in that form. It is well known that to reduce the problems derived from information asymmetries, there exist entities all over the world that mediate with the banks to give guarantees supporting the operations of SMEs. The Loan Guarantee Associations (LGAs) act as guarantors of SMEs in dealings with banks, with the object of reducing the risks for the financial entities in providing credits to small companies; such support helps small companies to get financing under better conditions of rate, term, and guarantee (Camino and Cardone, 1999; IDEA, 2003). In parallel, in many countries, with the aim of offering sufficient cover and guarantee for the risks contracted by the LGAs, and to facilitate the reduction of the cost of the guarantee for their partners, there exist reinsurance companies, whose objective is to provide a second or a backup guarantee for the operations guaranteed by an LGA. In Spain, it is the Compañía Española de Reafianzamiento, S.A. (CERSA), which provides the second guarantee to the banks.

As an initial approach, Cardone and Trujillo (2007) considered the impact of the guarantees given to SMEs by the LGAs in relation to the capital requirements demanded by BII, as well as their possible effects on the risk premium that the financial entities apply. They examined the effects on the credit risk premium that the banks had to charge to their SME clients, and whether this foreseeable theoretical reduction in the interest rates was compensated by the cost of the guarantee requested.

In the context of the European Union, BII was implemented in the form of two directives, Directive 2006/48/CE of the European Parliament and Council (14/6/06), relating to the taking up and pursuit of the business of credit institutions (recast), and Directive 2006/49/CE of the European Parliament and Council (14/06/06), on the capital adequacy of investment firms and credit institutions (recast)[2]. In our study, allusion will be made only to BII and then to the corresponding Spanish regulations (the Laws, Royal Decree, and the Bank of Spain Circular).

Section 2 of this study briefly presents the techniques for the mitigation of credit risk approved in BII, while Section 3 is an evaluation of the way in which SMEs' bank financing is treated under BII, taking into account the terms of capital required. Section 4 is devoted to analysing the impact of the results previously obtained on the credit risk premium and, ultimately, on the interest rates applicable to SMEs. In Section 5, we have discussed how the guarantee granted by the LGAs to SMEs influences the requirements with respect to the capital requirements under BII, and have analysed its possible effects on the credit risk premium (rate of interest). Section 6 is concerned with estimating the cost of the LGA guarantee. Finally, in Section 7 the principal conclusions are presented, followed by the bibliographical references.

## 2. Credit-Risk Mitigation Techniques According to BII

Financial entities use a number of techniques to mitigate the credit risks to which they are exposed. For example, exposures may be collateralised by first-priority claims (in whole or in part with cash or securities) guaranteed by a third party, or a bank may buy a credit derivative to offset various forms of credit risk. Additionally, financial entities may agree to net loans owed to them against deposits from the same counterparty.

The effect of this reduction of risk is that lower requirements of capital requirements are imposed under BII. Now the next question is whether all the types of guarantee offered by the borrower have equal capacity to reduce the risk for the financial entities (Vargas, 2001).

BII presents several credit-risk mitigation techniques, with acceptance of imperfect cover, which constitutes the basis for the approximation between the regulatory capital and the economic capital requirements. This basically means that the techniques with similar economic effects should also produce similar reductions of capital requirements.

Credit-risk mitigation techniques[3] used in BII are:

a) Collateralised transactions;

b) Guarantees and credit derivatives[4];

c) On-balance sheet netting.

In addition to the previous types, the following ones have an advantage of a differentiated treatment:

d) Exposures secured by mortgage and

e) Asset securitisation.

Although BII maintains the definition of regulatory capital unchanged, as established in BI, the form of determining the assets weighted by risk has been

changed considerably. In relation to the credit risk, two main approaches are established: the Standardised approach (based on external credit ratings provided by recognised rating agencies) and the IRB approach, based on the internal credit ratings made by the banks. This latter approach is in turn divided into foundation and advanced versions. It is the last version that gives the financial entities the maximum scope for calculating and computing for themselves the levels of regulatory capital associated with the credit risk.

The specific treatment given to each of the various types of credit-risk mitigation techniques, and hence, to the eligible assets or guarantors may differ according to the approach employed by the financial entity (Standardised, Foundation IRB, and Advanced IRB), although there are features common to all the three of them. In addition, the effect of the different credit-risk mitigation techniques on the regulatory capital, based on eligible approaches is also described.

To follow the analysis, refer to the description of the variables in Section 3.

***a)*** **Collateralised transactions*:*** The methodology described is the one applicable to assets or collateral of financial nature (cash, gold, equities, etc.). The loans secured by property assets (mortgage guarantees) are subjected to a differentiated treatment (see Table 1).

Financial entities are allowed to reduce their credit exposure to counterparty when calculating their capital requirements to take into account the risk mitigating effect of the collateral. In the case of the Standardised approach, banks may choose between the two approaches. The first one is a simple approach which, similar to the 1988 Accord, substitutes the risk weighting of the collateral for that of the counterparty, for the collateralised portion of the

exposure (generally subjected to a 20% floor). And the second one, a comprehensive approach allows fuller offset of the collateral against exposures, by effectively reducing the exposure amount by the value ascribed to the collateral.

Financial entities may operate under either one, but not both, of the approaches in the banking book. Although partial collateralisation is recognised in both the approaches, mismatches in the maturity of the underlying exposure and the collateral are only allowed under the comprehensive approach.

If a bank employs the foundation IRB approach for the treatment of the credit risk of its portfolio, the methodology for the recognition of eligible financial collateral closely follows that outlined in the comprehensive approach to collateral in the standardised approach. The financial entities that employ the advanced IRB approach will normally take into account the collateral by using their own internal estimations with the object of introducing an adjustment on the loss given default (LGD) of the exposure.

[Table 1]

***b) Guarantees and credit derivatives:***

A range of guarantors and protection providers are recognised, and under the 1988 Accord, a substitution approach would be applied. Thus, only guarantees issued by entities with a lower risk weight than the counterparty will lead to reduced capital charges, since the protected portion of the counterparty exposure is assigned the risk weight of the guarantor or protection provider, whereas the uncovered portion retains the risk weight of the underlying counterparty.

Although the lower probability of suffering a "double default" is recognised, it is not taken into account owing to the difficulty of determining the correlations between debtor and guarantor.

For the guarantee (or credit derivative) to be accepted as a mitigator of risks, it must be direct, explicit, irrevocable, and unconditional. BII demands a series of operational conditions aimed at ensuring the legal certainty of the cover (paragraphs 189–193 of BII) (see Table 2).

[Table 2]

***c) On-balance sheet netting:***

BII allows the banks that have legally enforceable netting arrangements for loans and deposits to calculate the capital requirements on the basis of the net credit exposures, subject to a series of conditions. The assets (loans) will be considered as exposures to risks and the liabilities (deposits) as collateral.

***d)* Exposures secured by mortgage*:***

In BII, the treatment of credits secured by property assets is different from that proposed generally for credits secured by financial assets, particularly in the Standardised and foundation IRB approaches (see Table 3).

[Table 3]

***e) Securitisation:***

The treatment of securitisation exposures is presented separately in Section IV of BII. Financial entities must apply the securitisation framework for determining the regulatory capital requirements on the exposures arising from

traditional or synthetic securitisations or similar structures that contain common features.

Since securitisations may be structured in many different ways, the capital treatment of a securitisation exposure must be determined on the basis of its economic substance rather than its legal form.

## 3. The Treatment of SMEs in BII

Under BII, an SME is understood as a company where the reported sales for the consolidated group of which the firm is a part is less than €50 million. Again, the way an SME is treated will differ according to the approach chosen by the particular financial entity, Standardised or IRB, and according to whether the bank includes the SME in the corporate or retail category.

### a) Standardised approach:

The financial entities must classify their exposures to risk according to various groups, and establish weights based on the credit rating given to the SME by an external credit-assessment institution (see Table 4).

[Table 4]

BII leaves it to the discretion of the national supervisor to allow financial entities to risk-weight all corporate claims at 100%, without regarding the external ratings.

Finally, SMEs included in a regulatory retail portfolio may be risk-weighted at 75%, except for the past due loans.

### b) IRB approach

The IRB approach is based on the internal estimations made by the financial entity, which allow the bank to calculate capital requirements that are more sensitive to the risk.

The Committee has made two IRB approaches available: a foundation and an advanced. Under the foundation approach, banks provide their own estimates of probability of default (PD) and rely on the supervisory estimates for other risk components: the loss given default (LGD), the exposure at default (EAD), and the effective maturity of the operation (M). Under the advanced approach, banks provide more of their own estimates of PD, LGD, EAD, and their own calculation of M, subject to meeting minimum standards.

For both the foundation and advanced approaches, banks must always use the risk-weight functions provided in BII for the purpose of deriving capital requirements.

With respect to the variables described, the following comments are relevant:

- **Probability of default (PD):** PD must be a long-run average of 1-year default rates for borrowers in the grade. The length of the underlying historical observation period used must be at least 5 years, and the bank is permitted to apply for its calculation by one or more of the following techniques: i) internal default experience; ii) mapping to external data; or iii) statistical default models. The PD is the greater of the 1-year PD associated with the internal borrower grade to which that exposure is assigned, or 0.03%.
- **Loss given default or severity (LGD):** LGD must be measured as a percentage of the EAD. Under the foundation approach, senior claims on

corporates not secured by recognised collateral will be assigned a 45% LGD, or 75% if the credit is subordinated.

- **Exposure at default (EAD):** Under the foundation IRB approach, for on-balance sheet items, the EAD is equal to the nominal amount of the operation. All exposures are measured as gross of the specific provisions or partial write-offs.
- **Effective maturity of the operation (M):** For banks using the foundation approach for corporate exposures, M will be 2.5 years. In the case of advanced IRB approach, M (in years) must be estimated, but this will not be >5 years.

The formulation to calculate the regulatory capital proposed by BII (see Table 5) includes the unexpected losses[5], for which capital is required to be assigned by the financial entity.

[Table 5]

The function (Equations [3] and [5]) is derived from an adaptation of Merton's (1974) single-asset model to credit portfolios. The confidence level is fixed at 99.9%, i.e., an institution is expected to suffer losses that exceed its level of capital on an average once in 1000 years.

*R* is the coefficient of asset correlation and is introduced to reflect a "portfolio effect," such that the greater this coefficient, the greater the capital required for the same PD. Correlations are adjusted to firm size, which is measured by annual sales. The linear size adjustment, shown in Equation [4] as $0.04 \times (1 - (S - 5)/45)$, affects corporates with annual sales of less than €50 million (SMEs). For SMEs with annual sales of €5 million or less, the size

adjustment takes the value of 0.04, thus lowering the asset correlation from 24% to 20% (best credit quality) and from 12% to 8% (worst credit quality).

The second part of Equation [3] shows the adjustment for the maturity of the loan. Both the intuition and empirical evidences indicate that long-term credits are riskier than the short-term ones. As a consequence, the capital requirement should increase with maturity. The M is the effective term or maturity of each operation, and $b = [0.11852 - 0.05478 \cdot \ln(PD)]^2$

With the aim of maintaining the current aggregate level of capital requirement in general terms, the BCBS decided to apply a 1.06 scaling factor for credit risk-weighted assets (calibration) in the IRB approach (May, 2006).

Once the capital requirement has been estimated, to derive risk-weighted assets (*RWAs*), it must be multiplied by EAD and the reciprocal of the minimum capital ratio of 8%, i.e. by a factor of 12.5.

Table 6 shows the capital requirement (CR), in %, for a loan to an SME according to different probabilities of default (0.03% and 20%) and different levels of total annual sales (less than €5 million, €30 million, and €50 million). It can be observed that the risk-weighting ranges between 11.98% and 199.72%, 13.79% and 230.24%, and 15.31% and 252.53%, respectively. It has been assumed that the loss in the event of default is 45%, and that the effective maturity of the loan is 2.5 years (both the data fixed by the regulator for the foundation approach).

[Table 6]

In the case when the financing granted to the SME is included in the retail category, the formula given in Equation [5] is used for calculating the regulatory capital. It should be observed that this function does not include an explicit maturity adjustment. For the retail positions, banks must provide their own

estimators of PD, LGD, and EAD, i.e., there is no distinction between a foundation and an advanced approach for this asset class. In addition, as in the case of financing provided to firms, a minimum PD of 0.03% is established.

Table 7 shows a simulation of different levels of CR demanded (PD of 0.03% and 20%) for a loan to an SME included in the retail category. Again, the LGD is assumed as 45%.

[Table 7]

From the examination of the different curves of capital, it can be observed how the own funds required are reduced in line with the dropping levels of annual sales in the borrower company – the differences between the curves being greater when the probability of default increases.

When the financing to the SME is considered as retail, the CR in both the approaches, Standardised and IRB, drops considerably.

## 4. Quantification of the Credit Risk Premium

The credit risk premium is the sum of two components[6]:

$$Credit\ Risk\ \text{Pr}emium\ (\%) = PD \cdot LGD + ROE \cdot CR \quad [7]$$

where

*PD*: Probability of default

*LGD*: Loss given default, as a percentage of the EAD.

*ROE*: Return on Equity.

*CR*: Regulatory capital "consumed" by the credit (i.e., the capital requirement specific to the loan), as a percentage of the EAD.

Analysis of each component of the credit risk premium:

i) The ***expected loss*** (EL) represents an average value of the expected losses owing to credit risk in 1 year from an economic perspective. It is estimated as the product of three variables already known:

Expected loss (*EL*) = *EAD x PD x LGD* [8]

Financial institutions view EL as a cost component of doing business, and manage them by a number of means, including through the pricing of credit exposures and provisioning. With respect to this, the amount imputable to the borrower in terms of "foreseen loss," as a percentage of the exposure to the risk, would be equal to PD $\times$ LGD.

ii) The ***cost of the regulatory capital***[7] that the loan in question "consumes," is obtained by multiplying this capital by any variable representative of the return required from it, for example, by the ROE ratio.

The financial entity must also consider the possibility of a "**not expected loss**" (unexpected loss or UL), derived from the volatility associated with the probability of default. This UL will be reflected in the assignment of own funds that constitutes the regulatory capital. Capital is needed to cover the risks of such losses, and therefore, it has a loss-absorbing function.

Interest rates, including credit risk premium, charged on credit exposures, should absorb the cost of these capital requirements.

Once the components that comprise the credit risk premium have been analysed, its amount for the SME as a function of the new capital requirements demanded by BII is quantified. According to the data from the Bank of Spain, the average ROE of Spanish financial entities during 2007 was 19.9%. If the LGD is

45%, then the credit risk premium is quantified for the Standardised and IRB approaches, as shown in Table 8.

[Table 8]

It can be observed that at higher rates of insolvency, the financial entities need a higher CR, and the higher rates of interest are applied to loan operations with SMEs.

- Standardised approach: The banks should charge the SME borrower (without credit rating) a higher credit risk premium, if the IRB approach was chosen in the lower sections of the curve, with lower probabilities of default.
- IRB approach: At a similar probability of default, the SME borrowers with lower annual sales will benefit more in terms of differential of interest, although it should be remembered that, in principle, the lower the annual sales volume of the SME, the higher is its probability of bankruptcy, *ceteris paribus*. In this way, BII tries to alleviate the burden represented by the new capital requirements for companies of small size as much as possible, by not excessively increasing the consequent risk premium.

## 5. The LGA in BII

The study conducted by Cardone, Casasola, and Samartín (2005) on a sample of 400 Spanish SMEs revealed that about 70% of the SMEs were required to present some type of credit-risk mitigation when requesting a loan. This requirement is more frequent for the smallest companies (85% of the micro companies, as against 51% of the companies of medium size). With respect to the type of credit-risk mitigation required, the most frequent are the guarantees (mainly monetary) not associated with the principal activity of the business. The

collateralised transactions (mostly mortgages) hardly accounted for 20% (see Table 9).

[Table 9]

The importance of the guarantee in financing appears to be strengthened under BII. As we analysed previously, for the loans guaranteed by any entity, the capital requirements are generally lower than for those collateralised by some type of asset, by mortgage or otherwise. Thus, for example, in the Standardised approach, the loans guaranteed by an entity of recognised creditworthiness will usually be weighted by 20%, against 35% for the credits secured by the residential mortgage (or by 50%, in exceptional cases, if the property mortgaged is commercial).

It is in this context that the guarantee awarded by an LGA becomes important. BII allows the effect of this cover to be taken into account, although both the guarantee and the LGA must meet a series of requirements for a reduction in the CR to be obtained. The treatment given to the loans guaranteed by an LGA is similar to that generally established for the guarantees and credit derivatives analysed in Section 2.

**a) Standardised approach**

Given that it is a guarantee, the "*principle of substitution*" is applied, which means that the operation guaranteed by an LGA is assigned the risk-weighting of the particular LGA involved. In the event that the guarantee is only partial, the uncovered portion of the exposure will retain the risk-weighting of the SME.

The risk-weighting applicable to the LGA will depend on their juridical status, which will determine the inclusion of the LGA in one category of risk or another[8].

If the LGA is configured as a public sector entity (PSE) or an administrative body, or as a non-commercial company owned by the Government, it may be appropriate to treat these claims in the same manner as the claims on banks, if the LGA is subjected to strict lending rules and a declaration of bankruptcy is not possible because of their special public status. Those LGAs taking the form of a mercantile company, but considered as credit institution by the supervisors (around 50% of the LGAs in Europe, including in Spain) may also be treated in the same manner.

In these cases, BII establishes two options, which the national supervisors must apply to all the entities over which they have the jurisdiction.

- **Option 1**: A risk-weighting corresponding to a category less favourable than that assigned to the sovereign debt of that country is applied to the LGA[9].
- **Option 2**: The second option bases the risk-weighting on the external credit assessment of the LGA itself with claims on unrated LGA being risk-weighted at 50%. Under this option, a preferential risk-weight that is one category more favourable may be applied to claims with an original maturity of ≤3 months, subjected to a floor of 20%[10]. These two options are summarised in Table 10.

[Table 10]

Therefore, for a loan to an SME that is not rated and wholly guaranteed by an LGA possessing the status of credit institutions, if the supervisor opts for the first of the two options in countries with a sovereign debt rating of AA or better, the CR will be:

20% × 8% = 1.6% of the amount financed, against:

100% × 8% = 8.0% or 6 % depending on whether the SME is treated as corporate or retail.

In this case, the amount guaranteed by the LGA is lesser than the amount of the loan, the bank and the LGA share losses on a pro-rata basis, and the capital relief will be afforded on a proportional basis. An adjustment will also be applicable when the systems of guarantees only provide protection for a period less than the maturity of the loan[11].

**b) IRB approach**

The treatment of the guarantee provided by an LGA differs depending on whether the financial entities utilise the values provided by the supervisors for the loss in the event of default or LGD (foundation IRB), or employ their own internal estimations (advanced IRB).

Under either of the approaches, credit risk mitigation in the form of guarantees must not reflect the effect of double default. Thus, if the bank recognises the guarantee, the adjusted risk-weight must not be less than that of a comparable direct exposure to the guarantor, in this case, the LGA.

*b.1) Foundation IRB*

The financial entities that utilise the foundation IRB approach for calculating their regulatory capital will recognise the guarantees provided by the LGA in the following way:

- The risk-weighting will be derived from the covered portion of the loan utilising:
  - The risk-weighting function appropriate for the LGA and

- The PD corresponding to the LGA or any intermediate rating between that of the SME and LGA, if the bank deems a full substitution treatment not to be warranted.

– The bank may replace the LGD of the underlying transaction with the LGD applicable to the guarantee, taking into account the seniority and any collateralisation of a guaranteed commitment.

The risk-weighting and the LGD associated with the SME will be assigned to the part not covered by the guarantee. The protection is thus partially recognised, as it would occur in the Standardised approach. At the same time, any mismatch between the term of the operation and the duration of the guarantee will be taken into consideration.

*b.2) Advanced IRB*

Banks using the advanced approach for estimating LGDs may reflect the risk-mitigating effect of guarantees through either adjusting PD or LGD estimates[12].

However, in contrast to the foundation approach, guarantees prescribing conditions under which the guarantor may not be obliged to perform (conditional guarantees) may be recognised under certain conditions.

*b.3) Retail Exposures*

The treatment proposed under BII for mitigating retail risks in the event of guarantees is very similar to that proposed for those financial entities that choose to make their own estimations of the LGD. Banks may reflect the risk-reducing effects of guarantees, either in support of an individual obligation or a pool of exposures, through an adjustment of either the PD or LGD estimate, if a

series of minimum requirements are met and with the prior approval of the competent authorities.

There are no restrictions on the types of eligible guarantors, if they meet the conditions established by the regulation, which are the same as under the advanced IRB approach.

**c) Reinsurance systems**

In Europe,[13] rather more than half of the guarantee systems (56%) have some kind of reinsurance, although in most cases this does not cover 100% of the operation[14], a requirement demanded under BII to alleviate the capital requirements in the Standardised approach.

However, it is clear that the backup guarantee represents a significant support to the creditworthiness of the LGA, and this fact is even recognised by the Spanish regulations[15]. In particular, it is recognised that, when a series of conditions are met, reinsurance is an instrument that reduces the credit risk, and consequently should lead to a reduction of the own resources (of the LGA) required with respect to those commitments that benefit from general contracts of second guarantees or reinsurance.

This signifies that the backup guarantee constitutes a variable to be considered when the bank estimates the PD or LGD applicable under the internal rating or IRB approach, except where the national legislation stipulates to the contrary. Thus, those SMEs endorsed by an LGA whose guarantees are in turn guaranteed to a significant percentage by any reinsurance company should benefit from the lower capital requirements by the lender financial entity.

Thus, having analysed the impact of the LGA guarantee on the CR demanded of financial entities for loans to SMEs, the next step is to determine its effect on the credit risk premium previously calculated. It has already been shown how the reduction of risk (as a consequence of the existence of the guarantee of the LGA) is translated into reduced capital requirements and, ultimately, into lower risk premiums (interest rates) chargeable to the SMEs, thus reducing the cost of credit for the SMEs.

The precise quantification of the new credit risk premium will depend not only on the value taken by the basic variables of the risk (mainly the PD and the LGD) for the endorsing LGA, but also on the approach that the bank employs for risk management (Standardised, foundation IRB, or advanced IRB approach) with respect to the component of "not expected losses."

It is almost certain that the probability of default of the LGA will be lower than that of the borrower SME; hence, the amount of the EL (the first component of the credit risk premium) should be considerably reduced. If the possible existence of reinsurance is added to this, and since both the SME and its endorsing LGA would need to become insolvent for the financial entity not to recover its money, the expected value of any loss would be even lower.

For the average values of the Spanish market for credit and different values of the PD of the guaranteeing company[16], the element of EL to be included in the credit risk premium has been simulated in Table 11. Assuming the average rates of default for SMEs as 2.64%, and as 2.92% for those companies with the due amount of more than (or less than) €1 million[17], the differences in the expected losses for credits guaranteed by an LGA range from 1.17% (1.30%), for very creditworthy LGA, to positive differences for those LGAs with worse credit assessments.

[Table 11]

With respect to the second component of the credit risk premium, which is representative of the cost of the capital required, its amount does differ now according to the approach that the financial entity chooses for the management of the risk.

In countries like Spain (with AAA rating), the factor for UL of the credit risk premium would be reduced by 1.27% and 0.88% for the SMEs included in the corporate and the retail category, respectively, in the event of opting for the Standardised approach and assuming that: i) the LGA is classified as a credit institution; ii) the loan operation is guaranteed for 100% of the amount, during the full life of the loan; and, finally, iii) the option chosen by the supervisor for claims on banks is the first (see Table 12).

[Table 12]

If the bank opts for the IRB approach, the quantification of the second element of the credit risk premium will depend, as we already know, on the PD of the LGA in question. It is assumed, as we already noted, that this should be lower than that of the SME guaranteed, causing a bigger reduction in the premium with the bigger difference between the two PDs. Thus, for an average rate of insolvency for the SME of 2.64%, and LGA of 0.03% (lower limit of the PD), the difference in the component of UL will be 1.36% for an SME with the annual sales of less than or equal to €5 million, and 1.85% if the annual sales of the company are around €50 million.

When the SME is treated as retail for the purposes of calculating the regulatory capital, for an average rate of default of 2.92%, the component of the premium for UL is reduced to 1.06%, and this factor could be reduced to 0.82% for an SME endorsed by an LGA.

As the PD of the LGA takes higher values (meaning that its credit rating gets worse), the differences become lower to the point where an average rate of default for the LGA of 1.07% makes the element of UL of the credit risk premium of an endorsed SME (with annual sales lower than €5 million and active risk of more than €1 million) equal to that of another without guarantee (see Table 13).

[Table 13]

Table 14 shows a summary of the estimated credit risk premiums (with average data for Spain) for the credits to SMEs guaranteed by an LGA, for different levels of creditworthiness. Although the differences with respect to the SMEs that are not endorsed depend on the approach employed by the bank for calculating its CR, these are about 2–3% for operations supported by an LGA with PD of 0.03%. When the creditworthiness of the LGA is worse, the differences narrow, to the point where, if the LGA has a PD of more than 2.64% (the average PD for the SMEs), the new credit risk premiums will exceed those for the SMEs that are not endorsed, in the IRB approach.

[Table 14]

## 6. Determining the Cost of the LGA Guarantee

Having reached this point, the subsequent questions are: What is the cost of the guarantee for the SME, and is this cost compensated by the reduction of the risk premium previously calculated that, in theory, the financial entity should translate into a lower rate of interest for an operation guaranteed by an LGA?

In guarantee systems of mutual type, like the Spanish one, those SMEs that are inclined to obtain a guarantee from an LGA must necessarily become partners (i.e. must participate in the ownership). However, once the credit has been amortised, the company can request the return of its participation. These

*recoverable contributions* (subscription quota or *SQ*) represent an opportunity cost for the SME borrower.

In addition, the SMEs that request a guarantee from an LGA must do so against a series of *non-recoverable costs*, specifically:

- The study commission (*SC*), charged as a percentage on the amount of guarantee requested, which is intended to reimburse the LGA for conducting a study of the viability of the project; this cost is incurred irrespective of whether the guarantee is finally conceded or not. It is paid only once, when the operation is requested.
- The commission in the concept of guarantee (*GC*), which is usually charged as a percentage of the amount due at the beginning of each accounting period; this is payable annually by the SME during the term of the guarantee. Its objective is to cover the possible insolvency of the partner endorsed and will depend on the method of amortisation of the loan granted by the financial entity.

To make it feasible to compare these costs with the credit risk premiums previously calculated, we must estimate the cost of the guarantee as an effective annual amount (IRR). This is given by the following equation of *n* degree:

$$0 = A - (SQ + SC) \cdot A - GC \cdot AD_1 - \frac{GC \cdot AD_2}{(1 + IRR)} - \ldots - \frac{GC \cdot AD_n}{(1 + IRR)^{n-1}} + \frac{GC \cdot A - A}{(1 + IRR)^n} \quad [9]$$

where

*A*: Amount of the guarantee

*SQ*: Subscription quota to the capital of the LGA

*SC*: Study commission

*GC*: Guarantee commission

$AD_t$: Amount due for the loan guaranteed at the beginning of year *t*

*n*: Term of the loan (in years)

In the most usual case of amortisation of a loan with constant annual repayments (French system) and for average data of the Spanish market for 2007, the result obtained after applying Equation [9] is 0.68% (see Table 15).

[Table 15]

## 7. Summary and Conclusions

The application of BII will bring important consequences for: i) the bank lenders, ii) the SME borrowers, and iii) the reciprocal guarantee companies, which are financial intermediaries whose importance is increasing and which appear, practically, all over the countries in the European Union.

i. For the financial entities, BII means working in a more stable financial environment. Once the financial entities have learnt how to measure, cover, and appropriately manage the risks to which their operations are exposed, they should face fewer situations of default; but if these situations do occur, they should be better placed to deal with them.

ii. For the SMEs, BII means the payment of premiums according to the risk of their business initiatives. In the past, the alternative involved restrictions in their access to credit, arising specifically from the difficulty that calibrating that risk presented for the financial entities. At the same time, the SMEs will need to be instructed in the management of risk, knowing that the lender will assess them in that respect.

iii. In the face of the challenge of BII, the LGAs must accept that, like the SMEs they guarantee, they may need to submit themselves to the same processes of measurement of risk as those to which their associates are submitted, i.e., at a credit rating.

The guarantee appears to be strengthened under BII. Generally, the loans guaranteed by another financial entity, like an LGA, will need backing by reduced amounts of regulatory capital when compared with those loans collateralised by assets (financial or not). Thus, if the financial entity applies the Standardised approach, the loans guaranteed by an LGA will usually be weighted by 20%, against 35% for the credits secured by a residential mortgage, or 50% in exceptional cases, if the property mortgaged is commercial.

Consequently, it is clear that when the credit to the SME is conceded with the guarantee of an LGA, this will reduce, in principle, the capital requirement demanded from the financial entity, although its final effect on the credit risk premium will depend on both:

a) The values taken by the credit variables of the LGA (principally the PD and the LGD) and
b) The approach that the financial entity employs for the management of the risk (Standardised, foundation IRB, or advanced IRB).

In the case of Spain:

- If the financial entity applies the Standardised approach, it can be assumed that the factor for UL of the credit risk premium is reduced by:

  1.27% for the SMEs included in the corporate category and

  0.88% for the SMEs considered as retail.

- When the IRB approach is applied, the amount of the UL will depend on the probability of default of the LGA. For an average rate of insolvency for the SME of 2.64%, and for the LGA of close to 0% (the best of the cases), the difference in the component of UL will be 1.36% for an SME with annual sales

of less than or equal to €5 million, and 1.85% if the annual sales of the company are up to €50 million. When the SME is treated as retail for the purpose of calculating the regulatory capital, then for an average rate of default of 2.92%, the component of the credit risk premium for UL is reduced to 1.06%; and this factor could be reduced to 0.82% for an SME guaranteed by an LGA.

If the component of EL (provisionable) is added, the credit risk premium is reduced on an average by 2–3% for operations guaranteed by an LGA whose PD is close to 0.03%. As the creditworthiness of the LGA gets worse, the differences get narrower, to the point that, for an LGA with PD of more than 2.64%, the new credit risk premiums exceed those of the SMEs not so guaranteed, in the IRB approach.

Considering that the cost of the LGA guarantee in Spain is around 0.68% (according to data for 2007), it will be advantageous for an SME with the annual sales of less than or equal to €5 million to request this guarantee whenever the PD of the LGA is <1.1%, if the approach utilised by the financial entity is the IRB and the SME is considered as corporate; however, if the SME is included in a regulatory retail portfolio, then the limit for the PD of the LGA decreases to 0.71%. On the other hand, when the approach utilised is the Standardised one, then will be profitable for an SME treated as retail to request this guarantee whenever the PD of the LGA is <3.35% (3.95% for corporate exposures) (see Table 14).

It is, therefore, necessary for the banks to make a detailed and meticulous analysis of the creditworthiness of the various LGAs, to determine their PD. Thus, it follows that in those countries that adopt BII, it is also necessary for the

development of credit agencies to be strengthened, for rating both SMEs and their financial intermediary guarantors, the LGA.

In this context, it also seems clear that the reinsurance companies have an important role to play in reinforcing the creditworthiness of the LGA; this importance has been recognised by some countries like Spain, in the legislation for implementing BII. The SMEs endorsed by an LGA, whose guarantees are in turn guaranteed to a significant percentage by a reinsurance company, should be rewarded with lower capital requirements by the lender, considering that this backup guarantee should be taken into account by the financial entity in the calculation of the PD or LGD when the IRB approach is used.

**Notes**

1. The importance of SMEs for the BCBS is evident from the various modifications that have been made to BII over the course of its development, with the object that the Agreement should not turn out to be too prejudicial for these companies, in terms of the capital required. The formulas for calculating the regulatory capital associated with SMEs by the banks have been modified thrice (in the consultative documents of 2001, 2003, and 2004).
2. These directives were incorporated into the Spanish juridical provisions through the issue of two new laws: i) for the sector of credit entities, the Law 36/2007 (16/11/07) [which modified the Law 13/1985, of 25 May] of investment coefficients, own resources and information obligations of financial intermediaries, and other rules for the financial system; and ii) for the sector of investment services companies, the Law 47/2007 [which modified the Law 24/1988, of 28 July] of the Securities Market. Finally, the

Royal Decree 216/2008 of 15 February, on the own resources of financial entities and the Circular 3/2008 of the Bank of Spain, completed the legal regulation, and from these acts and dates, all the cited regulations were put into effect. This "scalar transposition" culminated the incorporation of BII into the relevant Spanish legislation.

3. Bindseil and Papadia (2006) presented the principal credit-risk mitigation techniques utilised by almost all the central banks of the world. According to the authors, these coincide with most of those presented in BII.
4. The difference between collateral and guarantees and credit derivatives is that, in the case of the first, the financial entity receives an asset that it will be utilised in the event of default by the borrower. In the case of the second type, guarantees or credit derivatives, the guarantee is based only on a promise of payment (Deutsche Bundesbank Monthly Report, 2001). In addition, the financial entities may accept the compensation of loans by means of deposits made by the same customer.
5. While the expected loss represents the foreseeable loss from the operation from a statistical perspective, the unexpected loss refers to the variations that the expected loss may present beyond what has been estimated.
6. Financial entities can set limits to the risk that they are willing to assume, even if an adequate risk premium has been calculated.
7. A more exact determination of the credit risk premium would involve using the concept of economic capital instead of regulatory capital (Martín and Trujillo, 2004).
8. The credits guaranteed by the Government, whether central, regional, or local, will receive the most favourable treatment: it will not be necessary for

the bank to assign capital in the event that the rating of the State is AA or better.

9. However, for claims on banks in countries with sovereigns rated from BB+ to B− and on banks in unrated countries, the risk-weight will be capped at 100%.

10. Supervisors should ensure that claims with (contractual) original maturity of <3 months, which are expected to be rolled over (i.e., where the M is >3 months) do not qualify for this preferential treatment for capital adequacy purposes.

11. Maturity mismatches between the loan and the guarantee will only be recognised in those LGAs that cover at least 1 year of the life of the credit, which means that, for short-term loans, the duration of the cover must be equal to that of the underlying operation.

12. The criteria for adjustment must be clear, plausible, and intuitive, and must address the LGA's ability and willingness to perform under the guarantee. The criteria must also address the likely timing of any payments and the degree to which the LGA's ability to perform under the guarantee is correlated with the borrower's ability to repay. The bank's criteria must also consider the extent to which residual risk to the borrower remains, for example, a currency mismatch between the guarantee and the underlying exposure.

13. BII recognises the possibility that the countries that decide so may apply a lower risk-weighting to the set of credits endorsed by an LGA that is in turn counter-guaranteed indirectly by the Government, central, regional or local, through a reinsurance system.

14. The CERSA provides backup guarantees for the financial operations underwritten by the LGAs, to different percentages of cover according to the

type of operation. The cover for operations ranges from 30% to 75%; new company operations and those of innovative character enjoy more cover. The contracts establish a maximum cost of the cover calculated in function of a Q quality rate in the management of the risk.

15. Royal Decree 216/2008, of 15 February, with respect to the own resources of financial entities.

16. It is assumed that the LGD does not vary between the two situations, which is a restrictive hypothesis, since one would expect that its amount should be lower in an SME guaranteed by an LGA, since the financial entity in majority of the cases could be expected to recover at least some part of the amount loaned from both the SME and its LGA (which could even be backed up by a public system of reinsurance).

17. For the period 1995–2000, in Spain (Saurina and Trucharte, 2002).

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*Table 1*. Financial collateral.

<table>
<tr><th colspan="3">Standardised Approach</th></tr>
<tr><th></th><th>Eligible financial collateral</th><th>Calculation of the CR</th></tr>
<tr><td>Simple approach</td><td>- Cash<br>- Deposit in the financial entity<br>- Gold<br>- Sovereign debt instruments with a rating of BB- or better<br>- Other debt securities with a rating better than BBB-<br>- Debt securities without external rating these are listed on a recognised exchange.<br>- Equities (including convertible bonds) that are included in a main index.</td><td>- For collateral to be recognised in the simple approach, the collateral must be pledged for at least the life of the exposure and it must be marked to market and revalued with a minimum frequency of six months.<br>- Those portions of claims collateralised by the market value of recognised collateral receive the risk weight applicable to the collateral instrument.<br>- The risk weight on the collateralised portion will be subject to a floor of 20% except under the conditions specified in paragraphs 183 to 185 of BII.</td></tr>
<tr><td>Comprehensive approach</td><td>PLUS:<br><br>- Equities (including convertible bonds) which are not included in a main index but which are listed on a recognised exchange.<br>- UCITS/mutual funds which include such equities.</td><td>- In this approach, the exposure amount after risk mitigation is calculated as follows:<br>E* = max. {0, [E · (1 + He) - C · (1 - Hc - Hfx)]} [1]<br>where:<br>E*= the exposure value after risk mitigation.<br>E= current value of the exposure.<br>He= haircut appropriate to the exposure (exposure amounts may vary where, for example, securities are being lent).<br>C= the current value of the collateral received.<br>Hc= haircut appropriate to the collateral.<br>Hfx= haircut appropriate for currency mismatch between the collateral and exposure.<br>The exposure amount after risk mitigation will be multiplied by the risk weight of the counterparty to obtain the risk-weighted asset amount for the collateralised transaction.<br>- The haircuts (H) are calculated in function of the volatility of the collateral, its quality and period of maintenance.<br>- Standard supervisory haircuts:<br>- Assuming daily mark-to-market, daily remargining and a 10-business day holding period; in this case, the discount ranges from 0.5%, for sovereign debt issues with AAA/AA rating with a residual maturity of less than one year, up to 25% for equities not included in main indices. In the case of cash, the value of the haircut is 0.<br>▪ If the exposure and the collateral are denominated in different currencies, the standard supervisor discount applicable in respect of currency risk will be 8%.<br>- Own estimates for haircuts:<br>▪ Supervisors may permit banks to calculate haircuts using their own internal estimates of market prices volatility and foreign exchange volatility.<br>▪ To be authorised to do this, the financial entities must satisfy minimum criteria of qualitative and quantitative nature (paragraphs 156 to 165 of BII).<br>- Adjustments are established when the period elapsed between the valuations of the assets at market price (or the repositions of margins, if applicable) exceeds the minimum permitted.</td></tr>
<tr><th colspan="3">Foundation IRB approach</th></tr>
<tr><td colspan="2">All the preceding conditions</td><td>- In the case of the existence of an eligible IRB financial collateral only the Comprehensive approach is permitted, which is applied to the LGD, reducing it to:<br>LGD* = LGD x (E* / E) [2]<br>where:<br>▪ LGD is that of the senior unsecured exposure before recognition of collateral (45%);<br>▪ E is the current value of the exposure (i.e. cash lent or securities lent or posted);<br>▪ E* is the exposure value after risk mitigation, in accordance with the standardised approach. This concept is only utilised to calculate LGD*.<br>▪ Banks must continue to calculate EAD without taking into account the presence of any collateral, unless otherwise specified.</td></tr>
<tr><th colspan="3">Advanced IRB approach</th></tr>
<tr><td colspan="2">All the assets</td><td>- The financial entity makes its own estimate of the associated LGD.<br>- In its analysis, the financial entity must consider the degree of any dependence that may exist between the risk of the borrower and the risk of the collateral. When a significant degree of dependence exists, a conservative treatment will have to be applied.<br>- Any currency mismatch between the underlying obligation and the collateral must also be taken into account and treated conservatively.<br>- The estimates of LGD will be based on the historical rates of recovery and, wherever possible, must not be based exclusively on the estimated market value of the collateral.</td></tr>
</table>

*Table 2.* Guarantees and credit derivatives.

| | **Eligible guarantors/protection providers** | **Calculation of the CR** |
|---|---|---|
| **Standardised Approach** | - The guarantor can be: sovereign entities, Public sector entities, banks and securities firms with a lower risk weight than the counterparty;<br>- Companies (including insurance companies) with A- or better *rating*.<br>- The only credit derivatives admitted are: credit default swaps and total return swaps. The cash funded credit linked notes are treated as cash collateralised transactions. | - The risk weighting of the guarantor is assigned to the protected part, while the original weighting is assigned to the rest of the position.<br>- Proportional cover is recognised, by tranches, in respect of the difference between currencies and the possible maturity mismatches.<br>- Special treatment for sovereign guarantees and counter-guarantees. |
| **Foundation IRB approach** | - The range of eligible guarantors and credit derivatives is the same as under the standardised approach, but the internal ratings are utilised, in place of the external, for determining whether or not a guarantor is acceptable. | - The risk weighting will be derived from the covered part of the loan utilising:<br>a) the risk-weight function appropriate to the type of guarantor, and<br>b) the PD appropriate to the guarantor's borrower grade, or some grade between the underlying obligor and the guarantor's borrower grade if the bank deems a full substitution treatment not to be warranted. |
| **Advanced IRB approach** | - The same as the foundation IRB approach. However, if the financial entity chooses to adjust its LGD to reflect the guarantee, the range of eligible guarantors is not limited, although they must meet a series of minimum requirements (paragraphs 483 and 484 relating to the type of guarantee, paragraphs 488 and 489 for the credit derivatives). | - Adjustments will be made to the estimates of PD or LGD.<br>- The effect of double default must not be included in these adjustments.<br>- Retail portfolio*:* There is no difference between the foundation and advanced IRB approach. The financial entity must reflect the effect of the guarantee on its estimates of PD or LGD. |

*Table 3.* Exposures secured by mortgage.

| | **Eligible property** | **Calculation of the CR** |
|---|---|---|
| **Standardised Approach** | - Residential property | - Weighting of 35% |
| | - Commercial property | - Weighting of 100% |
| | - Exceptional case: Commercial property with particular characteristics (paragraph 74, BII). | - Weighting of 50% for the part of the loan that does not exceed the lower of the following two values: 50% of the market value, and 60% of the value of the mortgage on the property guaranteeing the loan |
| **Foundation IRB approach** | - Particular types of property are eligible as IRB collateral, provided a series of minimum requirements are met (paragraphs 509 to 524, BII). | - The LGD is reduced by up to 35-40%, according to the case (see paragraph 295, BII). |
| | - Again, in exceptional circumstances, mortgages on some commercial property are recognised. | - The LGD corresponding to the collateralised part of these exposures is fixed at 35%. |
| **Advanced IRB approach** | - The treatment of exposures secured by mortgage generally is that presented for the rest of the assets, as described in table 1. | - A specific formulation is established for the case of retail positions guaranteed by residential dwellings. |

*Table 4*. Standardised approach: Regulatory capital for an SME.

| | **Capital Requirements** |
|---|---|
| The financing of SMEs may be included in one of two alternative business categories:<br><br>**A) *Corporate*** | - Risk weighting according to credit rating:<br>▪ 20% (AAA to AA-)<br>▪ 50% (A+ to A-)<br>▪ 100% (BBB+ to BB-)<br>▪ 150% (Lower than BB-)<br>▪ 100% (Not rated)<br><br>EXAMPLE: For a exposure of €10 million, the CR would vary between:<br><br>€160,000 = (8% x 20% x €10 million)<br>€1,200,000 = (8% x 150% x €10 million) |
| **B) Retail*:*** Conditions:<br><br>i) Maximum aggregate exposure ≤ €1 million, and<br>ii) It forms part of a diversified portfolio (aggregate exposure to one counterpart less than 0.2% of the overall regulatory retail portfolio). | - Risk weighting of 75%, except for past due loans.<br>- EXAMPLE: For a loan of €100,000 to an SME, the financial entities must assign €6,000 as regulatory capital (8% x 75% x €100,000), which is 6% of the amount of the loan to the customer. |

*Table 5*. IRB approach: Regulatory capital for an SME.

| | **Capital Requirements** |
|---|---|
| **A) Corporate** | $$CR = \left\langle LGD \times N\left[\frac{G(PD)+\sqrt{R}\times G(0.999)}{\sqrt{1-R}}\right] - PD\times LGD\right\rangle \cdot \left\langle \frac{1+(M-2.5)\times b}{1-1.5\times b}\right\rangle \times 1.06 \quad [3]$$<br>where<br>$$Correlation\ (R) = 0.12\times\left(\frac{1-e^{-50\times PD}}{1-e^{-50}}\right)+0.24\times\left[1-\left(\frac{1-e^{-50\times PD}}{1-e^{-50}}\right)\right]-0.04\times\left(\frac{1-(S-5)}{45}\right) \quad [4]$$ |
| **B) *Retail***<br>Condition: The total exposure of the banking group to a small business borrower (on a consolidated basis where applicable) is less than €1 million. | $$CR = \left\langle LGD\times N\left[\frac{G(PD)+\sqrt{R}\times G(0.999)}{\sqrt{1-R}}\right] - PD\times LGD\right\rangle \times 1.06 \quad [5]$$<br>where<br>$$Correlation\ (R) = 0.03\times\left(\frac{1-e^{-35\times PD}}{1-e^{-35}}\right)+0.16\times\left[1-\left(\frac{1-e^{-35\times PD}}{1-e^{-35}}\right)\right] \quad [6]$$ |
| Where:<br>CR: Capital requirement or regulatory capital, as a percentage of the EAD<br>LGD: Loss given default<br>N (x): Cumulative distribution function for a standard normal random variable<br>R: Asset Correlation<br>G (z): Inverse cumulative distribution function for a standard normal random variable<br>PD: Probability of default<br>M: Maturity of the operation<br>*b:* Maturity adjustment<br>S: Total annual sales in millions of euros | |

*Table 6.* IRB approach: Capital requirements for SMEs (as corporate).

| PD | S | R | LGD | M | b | CR | RWA |
|---|---|---|---|---|---|---|---|
| 0.03% | **≤ 5** | 0.19821 | 45% | 2.5 | 0.316834 | 0.96% | 11.98% |
| 20.00% | **≤ 5** | 0.08001 | 45% | 2.5 | 0.042719 | 15.98% | 199.72% |
| 0.03% | **30** | 0.22044 | 45% | 2.5 | 0.316834 | 1.10% | 13.79% |
| 20.00% | **30** | 0.10223 | 45% | 2.5 | 0.042719 | 18.42% | 230.24% |
| 0.03% | **50** | 0.23821 | 45% | 2.5 | 0.316834 | 1.22% | 15.31% |
| 20.00% | **50** | 0.12001 | 45% | 2.5 | 0.042719 | 20.20% | 252.53% |

*Table 7*. IRB approach: Capital requirements for SMEs (as retail).

| PD | R | LGD | CR | RWA |
|---|---|---|---|---|
| 0.03% | 0.15864 | 45% | 0.38% | 4.72% |
| 20.00% | 0.03012 | 45% | 8.50% | 106.29% |

*Table 8.* Credit risk premiums, as a percentage of the EAD.

| **STANDARDISED APPROACH** | | | | | | |
|---|---|---|---|---|---|---|
| **Unrated claims on corporates** | | | | | | |
| **PD** | **LGD** | **EL** | **ROE** | **CR** | **ROE x CR** | **Credit Risk Premium** |
| 0.03% | 45.00% | 0.01% | 19.90% | 8.00% | 1.59% | 1.61% |
| 20.00% | 45.00% | 9.00% | 19.90% | 8.00% | 1.59% | 10.59% |
| **Retail** | | | | | | |
| 0.03% | 45.00% | 0.01% | 19.90% | 6.00% | 1.19% | 1.21% |
| 20.00% | 45.00% | 9.00% | 19.90% | 6.00% | 1.19% | 10.19% |
| **IRB APPROACH** | | | | | | |
| **Corporates with sales ≤ €5 million** | | | | | | |
| 0.03% | 45.00% | 0.01% | 19.90% | 0.96% | 0.19% | 0.20% |
| 20.00% | 45.00% | 9.00% | 19.90% | 15.98% | 3.18% | 12.18% |
| **Corporates with sales of €30 million** | | | | | | |
| 0.03% | 45.00% | 0.01% | 19.90% | 1.10% | 0.22% | 0.23% |
| 20.00% | 45.00% | 9.00% | 19.90% | 18.42% | 3.67% | 12.67% |
| **Corporates with sales of €50 million** | | | | | | |
| 0.03% | 45.00% | 0.01% | 19.90% | 1.22% | 0.24% | 0.26% |
| 20.00% | 45.00% | 9.00% | 19.90% | 20.20% | 4.02% | 13.02% |
| **Retail** | | | | | | |
| 0.03% | 45.00% | 0.01% | 19.90% | 0.38% | 0.08% | 0.09% |
| 20.00% | 45.00% | 9.00% | 19.90% | 8.50% | 1.69% | 10.69% |

*Table 9.* Credit risk mitigation techniques required to an SME in Spain.

| | Total | Micro Companies (< 10 employers) | Small companies (from 10 to 49 empl.) | Medium companies (from 50 to 249 empl.) |
|---|---|---|---|---|
| Credit risk mitigation required | 69.4% | 85.16% | 65.06% | 50.85% |
| Guarantees not associated with the business | 56.37% | 68.6% | 54.5% | 29.7% |
| Guarantees associated with the business | 20.36% | 17.9% | 25.41% | 13.5% |
| Collateral not associated with the business | 17.95% | 20.54% | 15% | 16.2% |
| Collateral associated with the business | 19.78% | 15.18% | 20.83% | 32.43% |

**Source**: Cardone, Casasola & Samartin (2005)

*Table 10.* Standardised approach: Risk-weighting of an exposure guaranteed by an LGA.

| **Option 1** | | | | | | |
|---|---|---|---|---|---|---|
| **Credit assessment of Sovereign** | **AAA to AA-** | **A+ to A-** | **BBB+ to BBB-** | **BB+ to B-** | **Below B-** | **Unrated** |
| Risk weight under Option 1 | 20% | 50% | 100% | 100% | 150% | 100% |
| **Option 2** | | | | | | |
| **Credit assessment of LGAs** | **AAA to AA-** | **A+ to A-** | **BBB+ to BBB-** | **BB+ to B-** | **Below B-** | **Unrated** |
| Risk weight under Option 2 | 20% | 50% | 50% | 100% | 150% | 50% |
| Risk weight for short-term claims under Option 2 | 20% | 20% | 20% | 50% | 150% | 20% |

*Table 11*. EL in credit risk premiums for SMEs.

| **Total Exposure ≥ €1 M** | | | | | | |
|---|---|---|---|---|---|---|
| **SME without guarantee** | | | **SME guaranteed by an LGA** | | | **Difference EL (2) – (1)** |
| **PD SME** | **LGD** | **EL (1): PD x LGD** | **PD LGA** | **LGD** | **EL (2): PD x LGD** | |
| 2.64% | 45.00% | 1.19% | 0.03% | 45.00% | 0.01% | -1.17% |
| 2.64% | 45.00% | 1.19% | 3.00% | 45.00% | 1.35% | 0.16% |
| **Total Exposure < €1 M** | | | | | | |
| 2.92% | 45.00% | 1.31% | 0.03% | 45.00% | 0.01% | -1.30% |
| 2.92% | 45.00% | 1.31% | 3.00% | 45.00% | 1.35% | 0.04% |

*Table 12*. Standardised approach: Component of UL in credit risk premiums for SMEs.

| Unrated corporates | | | | | |
|---|---|---|---|---|---|
| ROE | SME without guarantee | | SME guaranteed by an LGA | | Difference (2) – (1) |
| | CR | ROE x CR (1) | CR | ROE x CR (2) | |
| 19.90% | 8.00% | 1.59% | 1.60% | 0.32% | -1.27% |
| **Retail** | | | | | |
| 19.90% | 6.00% | 1.19% | 1.60% | 0.32% | -0.88% |

*Table 13.* IRB Approach: Component of UL in credit risk premiums for SMEs.

| Unrated corporates without guarantee | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PD SME | S | R | LGD | M | b | CR | ROE | ROE x CR |
| 2.64% | ≤ 5 | 0.11206 | 45% | 2.5 | 0.100877 | 8.03% | 19.9% | 1,60% |
| 2.64% | 30 | 0.13428 | 45% | 2.5 | 0.100877 | 9.40% | 19.9% | 1,87% |
| 2.64% | 50 | 0.15206 | 45% | 2.5 | 0.100877 | 10.51% | 19.9% | 2,09% |

| Retail without guarantee | | | | | |
|---|---|---|---|---|---|
| PD SME | R | LGD | CR | ROE | ROE x CR |
| 2.92% | 0.07678 | 45% | 5.30% | 19.9% | 1.06% |

| SMEs guaranteed by an LGA | | | | | | | |
|---|---|---|---|---|---|---|---|
| PD LGA | R | LGD | M | b | CR | ROE | ROE x CR |
| 0.03% | 0.23821 | 45% | 2.5 | 0.316834 | 1.22% | 19.9% | 0.24% |
| 1.07% | 0.19028 | 45% | 2.5 | 0.134751 | 8.02% | 19.9% | 1.60% |

*Table 14.* Credit risk premiums for SMEs guaranteed by an LGA, as a percentage of the EAD.

| | SMEs without guarantee | | | SMEs guaranteed by an LGA with PD = 0.03% | | | | SMEs guaranteed by an LGA with PD = 0.71% | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **EL** | **ROE x CR** | **Credit Risk Premium (1)** | **EL** | **ROE x CR** | **Credit Risk Premium (2)** | **Difference (2) – (1)** | **EL** | **ROE x CR** | **Credit Risk Premium (3)** | **Difference (3) – (1)** |
| **RPcorp ST** | 1.19% | 1.59% | 2.78% | 0.01% | 0.32% | 0.33% | -2.45% | 0.32% | 0.32% | 0.64% | -2.14% |
| **RPretail ST** | 1.31% | 1.19% | 2.51% | 0.01% | 0.32% | 0.33% | -2.18% | 0.32% | 0.32% | 0.64% | -1.87% |
| **RPcorp. S= 5 (IRB)** | 1.19% | 1.60% | 2.79% | 0.01% | 0.24% | 0.26% | -2.53% | 0.32% | 1.37% | 1.69% | -1.10% |
| **RPcorp. S=30 (IRB)** | 1.19% | 1.87% | 3.06% | 0.01% | 0.24% | 0.26% | -2.80% | 0.32% | 1.37% | 1.69% | -1.37% |
| **RPcorp. S=50 (IRB)** | 1.19% | 2.09% | 3.28% | 0.01% | 0.24% | 0.26% | -3.02% | 0.32% | 1.37% | 1.69% | -1.59% |
| **RPretail IRB** | 1.31% | 1.06% | 2.37% | 0.01% | 0.24% | 0.26% | -2.11% | 0.32% | 1.37% | 1.69% | **-0.68%** |

| | SMEs guaranteed by an LGA with PD = 1.1% | | | | SMEs guaranteed by an LGA with PD = 2.64% | | | | SMEs guaranteed by an LGA with PD = 3.35% | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **EL** | **ROE x CR** | **Credit Risk Premium (4)** | **Difference (4) – (1)** | **EL** | **ROE x CR** | **Credit Risk Premium (5)** | **Difference (5) – (1)** | **EL** | **ROE x CR** | **Credit Risk Premium (6)** | **Difference (6) – (1)** |
| **RPcorp ST** | 0.50% | 0.32% | 0.81% | -1.97% | 1.19% | 0.32% | 1.51% | -1.27% | 1.51% | 0.32% | 1.83% | -0.95% |
| **RPretail ST** | 0.50% | 0.32% | 0.81% | -1.69% | 1.19% | 0.32% | 1.51% | -1.00% | 1.51% | 0.32% | 1.83% | **-0.68%** |
| **RPcorp. S= 5 (IRB)** | 0.50% | 1.61% | 2.11% | **-0.68%** | 1.19% | 2.09% | 3.28% | 0.50% | 1.51% | 2.24% | 3.74% | 0.96% |
| **RPcorp. S=30 (IRB)** | 0.50% | 1.61% | 2.11% | -0.95% | 1.19% | 2.09% | 3.28% | 0.22% | 1.51% | 2.24% | 3.74% | 0.68% |
| **RPcorp. S=50 (IRB)** | 0.50% | 1.61% | 2.11% | -1.17% | 1.19% | 2.09% | 3.28% | **0.00%** | 1.51% | 2.24% | 3.74% | 0.46% |
| **RPretail IRB** | 0.50% | 1.61% | 2.11% | -0.26% | 1.19% | 2.09% | 3.28% | 0.91% | 1.51% | 2.24% | 3.74% | 1.37% |

Notes:
*RPcorp ST:* Credit risk premium for an unrated SME included in the corporate category, in the Standardised approach.
*RPretail ST*: Credit risk premium for an SME included in the retail category, in the Standardised approach.
*RPcorp, S = 5*: Credit risk premium for an SME with annual sales of less than or equal to €5 million included in the corporate category (IRB approach).
*RPcorp, S=30*: Credit risk premium for an SME with annual sales of €30 million included in the corporate category (IRB approach).
*RPcorp, S=50*: Credit risk premium for an SME with annual sales of €50 million included in the corporate category (IRB approach).
*RPretail IRB*: Credit risk premium for an SME included in the retail category (IRB approach).

*Table 15.* Effective annual cost (IRR) of the LGA guarantee (data for Spain, 2007).

| | |
|---|---|
| Amount of the Guarantee (A) | €66,000 |
| Study commission (SC) | 0.5% |
| Guarantee commission (GC) | 1.0% |
| Contribution to the Capital of the LGA (SQ) | 1.0% |
| Rate of interest (i) | 6.0% |
| Term of the loan (n) | 8 years |
| **Effective cost of the guarantee (IRR)** | **0.68%** |

**Source:** CESGAR (2008)